New regulations protect underground LPG supply in Kansas

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Regulations were adopted in 2003 for facilities that store liquified petroleum gas (LPG) in salt caverns. Salt caverns are considered to be safe containment for LPG due to the nonporous and impermeable nature of the salt. In Kansas, storage caverns are developed in the Hutchinson Salt. The depth of the Hutchinson Salt at existing facilities ranges from approximately 400 ft to 1,000 feet below ground surface. The salt caverns are formed by dissolving the salt with fresh water that has been injected into the salt through deep wells.

Storage is based on the basic principle of "oil floats on water." LPG products, such as propane and butane, become liquified when stored under pressure. In the cavern, LPG floats on a layer of brine **(Figure 2).** Brine is transferred into the cavern, via the well, to push the floating LPG out. Brine is transferred out of the cavern when LPG is transferred into the cavern for storage. Brine not being used to transfer LPG is stored in brine ponds **(Figure 3).**

Figure 1

LPG is stored in nine Kansas facilities located close to the towns of McPherson, Hutchinson, and Bushton. Currently, the storage facilities have a total of 400+ active caverns with an average storage capacity of 170,000 barrels per cavern. Capacity is measured in stock tank barrels with a barrel being equivalent to 42 gallons. Forty-three brine ponds, ranging in size from 1.3 to 18.4 acres, deliver the brine necessary to move the LPG in and out of the caverns. The storage capacity for the brine ponds ranges from 88,000 to 1,150,000 barrels per pond. **Figure 1** is an aerial photo of a storage facility near Hutchinson.

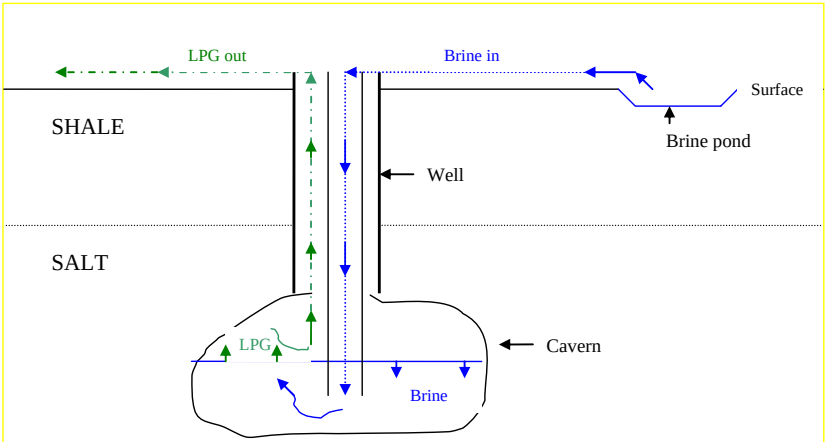

Figure 2 LPG Process – Transferring brine in to move LPG out (not to scale)

The 2003 regulations were written to ensure that the integrity of the storage system is maintained to protect public health, safety and the environment. The regulations required the installation of a supervisory control and data acquisition (SCADA) system. SCADA is an automated system that allows operators to monitor cavern pressures, LPG and brine flow, and various safety parameters at each well from a remote location. Emergency

shut-down systems are a part of the SCADA to ensure that the well is shut down if any safety issues arise. **Figure 4** shows a well that is fully equipped with the required safety and warning devices.

The regulations also required routine testing, monitoring, and logging at each well to ensure that the physical condition of the well and the cavern is maintained. The most important safety considerations include verifying that the well's steel casing is in good condition, that early warning and shut-down systems are operational, and that an adequate thickness of salt is present for the safe containment of the LPG.

Figure 3: Brine Storage Pond

Regulations were also written for the construction and operation of the brine ponds. Newly constructed brine ponds must have a double-liner to ensure that any brine leaks will be contained to protect the environment from brine contamination. Facilities are required to reline existing brine ponds with a double liner if the pond requires repair or liner replacement. Additionally, each brine pond is equipped with a degassifier and a flare to ensure that any LPG that has become entrained in the brine will be separated out and sent to the flare **(Figure 5)**.

Figure 4: Well equipped with safety and warning devices.

The regulations initiated a flurry of activity when they were adopted in 2003. All the storage facilities met the regulatory deadline of April 1, 2008 for the installation of required safety equipment and warning systems. The facilities continue to conduct routine monitoring and testing to ensure the protection of public health, safety, and the environment.

Figure 5: Degassifer (horizontal tank) and flare (vertical stack)